"TRANSFER PRICING"--CAN IT EFFECTIVELY BE APPLIED TO COMPUTER SERVICES?

An abstract of a Thesis by
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The problem. From a financial point of view, the primary function of the data processing department is to maximize the benefit the firm receives from its data processing resources. Though such a goal may be generally accepted, it is not entirely clear how it is achieved. This thesis seeks to remedy this situation by applying transfer price to computer services.

Procedure. The research procedure consisted of an analysis of transfer price theory and its varied applications. Next, the most generally accepted methods of transfer price theory were applied to an actual computer processing site to determine if any were applicable.

Findings. Transfer pricing is most generally applied in one of the following four alternatives: (1) market price, a price based on a competitive external market; (2) negotiated price, a price mutually agreed to by the parties involved; (3) marginal cost, a price based on costs that vary with output and; (4) full cost, price based on variable and fixed costs of the supplying division.

Three units of transfer were determined, batch processing, online processing and developmental. Given four objectives, transfer price must be equitable, reproducible, understandable and return no profit or loss. Full cost approach was found to be the most applicable.

Recommendations. The transfer price system as developed herein be implemented in a test environment initially. Even though the full cost alternative appeared to be the "best," a hint of marginal cost was obvious. The marginal cost would be a horizontal line or a close approximation. After a period of time, cost trends will substantiate the system or support the marginal cost approach.

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A Thesis

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by

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TABLE OF CONTENTS

LIST OF TABLES

Chapter I

INTRODUCTION

Background. Since conception twenty plus years ago, the data processing profession has demonstrated a growth that is unparalleled by any other profession in the history of man. In April of 1951, the first commercially available computer went into operation at the Bureau of Census; and three years later in 1954, the first computer installation for business applications went into operation at the General Electric Appliance Park in Louisville, Kentucky.

To many, this may not appear to be such a startling thought, but contrast this situation to today's situation and it becomes immediately apparent that a phenomenon has taken place which has influenced significantly the growth of our economy. To say that today there are twenty thousand or twenty million computers in operation is irrelevant, but when one considers that data processing budgets are averaging from one to four percent of a company's costs, it becomes apparent just how phenomenal this growth has been.[1] In growing from a one installation environment to one in which data processing has become a major profession, so too, has the cost grown.

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[1] T. H. Larson, "A 20 Year Ripoff," Infosystems, November 1974, p. 26.

A study conducted by Datamation magazine is summarized to show actual dollar relations. This study was conducted on a cross section of 269 installations to indicate the dollar growth in data processing budgets from the year 1972 to the year of 1973. Based on this cross section the budgets in 1973 were $245 million as compared to $220 million in 1972. In one years time, this amounts to a cost increase of 11.3%.[1] Table 1 illustrates this cost by the applicable budget factors.

The analysis and samples used by Datamation, in their estimation, is large enough that the proportions shown in Table 1 can be projected to the U.S. data processing universe for the year 1973. This projection is shown in Table 2. The projected figure is $24.5 billion.

Based on the above brief summation of the Datamation study, it is obvious that data processing has become a giant and has taken on a very important role in today's economy. But a question must be asked, why has the cost of data processing kept pace with, if not outrun its phenomenal physical growth? It is this factor along with the continued rising cost curves in the total industry that is forcing more and more companies to become aware of this phenomenal growth in computer cost. It is this awareness

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[1] R. A. McLaughlin, "A Survey of D.P. Budgets for 1973," Datamation, February 1973, p. 61.

Table 1

Sample Data Processing Expenditures
U. S. and Canada

	1972* Dollars	Sample	1973* Dollars	Sample	% Chg.
Hardware	$ 86,370	269	$ 98,110	269	13.6
Rented	47,840	203	51,820	201	8.3
Purchased	9,940	60	13,490	81	35.8
Leased	28,590	118	32,800	121	14.9
Software	1,560	87	2,280	98	46.2
Data Comm.	11,430	98	14,570	134	27.5
Supplies	12,900**	269	14,490**	269	12.3
Consultants	840	48	870	47	3.6
Training	760	135	1,030	146	35.6
Conferences	320	141	400	146	25.0
Time Sharing	1,260	45	1,470	46	16.7
Batch Proc.	840	24	1,040	22	23.8
Remote Batch	390	13	450	13	15.4
Contract Prog.	1,780	45	1,560	42	12.4
Salaries	102,450***	269	109,470***	269	7.1
Total	220,450		245,470		11.3

* In thousands

** The average of 247 responses multiplied to yield 269 responses.

*** The average of 223 responses multiplied to yield 269 responses.

Table 2

Major D. P. Budget Items for 1973

	Total Dollars	% of Total
Hardware	9.8 B	40
Salaries	10.9 B	44.6
Others	3.8 B	15.4
Software		.9
Data Comm.		5.9
Supplies		5.9
Consulting		.4
Training		.4
Conferences		.2
Time Sharing		.6
Batch Proc.		.4
Remote Batch		.2
Contract Prog.		.6
Total	24.5 Billion	100

that has resulted in many corporate officials asking the questions, why are computer costs so high and are we getting our moneys worth?

Problem. This question appears to be one which should not be difficult to answer. Costs of data processing are a direct result of services rendered by the computer and given the cost for the services, one can determine the "why" so high, and accordingly, what measures can be taken to reduce cost. This is not a simple question. To accurately answer this question one must place a charge on the service that is rendered by the computer. Not only would this account for the high cost of data processing, but it would also educate corporate management on the capabilities of the computer, capabilities measured against dollars. However, it is surprising that with all the sophisticated tools that management has to control cost (the computer being one of its primary tools), that very little has been done in the area of transfer price theory of costing out computer services.[1] Tough minded management for some reason is unable to extend its authority into the EDP world. They accept the presumed sophistication and computer jargon that are said to make EDP activities somehow "immune" from normal management demands and controls.

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[1] K. Gabrielle and J. Wiorkowski, "A cost of Allocation Model," Datamation, August 1973, p. 60.

There are three reasons for this presumed attitude. First, the computer was and is considered a cost reducing machine. For every dollar spent in the developing and installing of a system, two dollars are saved. Second, the complexities of the environment mystifies the layman. These two reasons coupled with the third, rapid growth and constant change, has resulted in upper management not being able to keep pace. Management hears the terminology "multiprocessing", "teleprocessing", "online", "real time", "batch", "CPU", etc., and yet they do not comprehend.

It is the intent of this paper to develop a method of transfer pricing for computer services. To do this, one has to determine the costs of these services, and then base the transfer price method on these costs. As a result, other divisions or departments can determine if the computer services are worth it to them. The concept of transfer price simply means a method or methods by which products and/or services are transferred between divisions of a firm. In essence, the division or department requiring the product or service of the other department or division would buy it. Conceptually, the firm is trying to rationalize resource usage with a transfer price method.

Thesis outline. Chapter II concentrates on defining transfer price theory and reviews several different transfer price methods. Chapter III addresses transfer price theory as it applies to data processing and its environment.

Chapter IV determines or develops a transfer price method for computer service. Chapter V describes the transfer price method developed, how it will or will not work, and Chapter VI is conclusions and recommendations. As noted, Chapter V describes an actual developed transfer price method for computer services. This is accomplished by developing such a system for a manufacturing company of medium size data processing resources. Actual data processing data is utilized in this study. The subject manufacturing company hereafter is referred to as XYZ company.

Chapter II

"TRANSFER PRICING" - THEORY OR FACT?

In this chapter, the theory of "Transfer Pricing" and its applications are developed.

Transfer price theory. This is a term that has become associated with large corporations which have decentralized and have developed divisional organizations. Simply stated, transfer pricing is the method by which products and/or services are transferred between divisions. As with most decentralized organizations, the separate divisions are known as "profit centers" and are virtually autonomous in their decision making processes. There are two principal objectives of transfer pricing as it applies to profit centers: first, a means to measure the performance of managers in terms of their divisions contribution to the firm's profit, and second, to achieve "goal congruence", a condition which exists whenever the actions taken by managers to make themselves look good (performance measurements) will be identical to the action which they would take to achieve the objectives of the firm.[1] Transfer pricing is, therefore, the pricing of goods and services that are exchanged between

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[1] G. L. Holstrum and E. H. Sauls, "The Opportunity Cost Transfer Price," Management Accounting, May 1973, p. 29.

divisions within a firm. The difficult consideration that must be addressed is how the price should be set in order to induce each division to act in a "profit maximization" manner for the good of the whole firm.

There are four basic alternative strategies related to transfer price methodology. They are: Market Price, Negotiated Price, Full Cost and Marginal Cost. "Market Price" implies that the product and/or service being rendered has an external market, as well as the market of the internal division of the firm. The price in this approach would simply be that which is currently prevailing in the market. One qualification required at this point is addressed by Jack Hirshleifer in his article, "Economics of Transfer Pricing", in which he states that the market price is the correct transfer price only when the commodity being transferred is produced in a competitive market, that is, perfectly competitive.[1]

According to Richard B. Troxel in his writings on transfer pricing, there are four problems in the use of a market price.[2] First, it is almost impossible to create exactly the conditions that would exist in an external

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[1] J. Hirshleifer, "On the Economics of Transfer Pricing," Journal of Business, July 1956, p. 172.

[2] R. B. Troxel, "On Transfer Pricing," C.P.A. Journal, October 1973, p. 896.

market, for example quality, quantity, delivery and other marketing factors. Therefore, the establishment and use of the market price would be difficult to account for. Second, the external price is often time influenced by quantity discounts, payment terms, and other types of marketing concessions. Third, the supplying division would experience lower distribution cost since the product is destined for internal consumption. Fourth, even with an established market price the buying division may be restricted by corporate policy from buying from an external market. Given the above, it is obvious that a true market price would lead to some variation of market price.

The second basic alternative is "negotiated price". This price usually is established as a close approximation of market price because of the problems as outlined above as related to market price. This price is nothing more than an agreed to price established by divisional managers in negotiation sessions. Usually the prices are established according to guidelines set by a corporate staff. Negotiated price definitely provides a means for measuring a manager's performance and productivity, as well as his negotiating ability. It is this negotiating ability which may make it contrary to the goal of the firm; there is no way to guarantee that negotiated transfer price would lead to goal

congruence.[1]

The third alternative "full cost", establishes a price which includes both variable costs and allocated fixed costs of the supplying division. The price may be based on standard or actual costs and the amount may or may not be inflated to account for a specific profit margin.

The last alternative "marginal cost", determines a price based on the costs that vary with the output of the supplying division. These costs are variable and incremental costs as defined by the accountant and are truly the economist's definition of marginal cost as will be referred to in Hirshleifer's writings.

These, then, are the four generally discussed alternatives to transfer pricing. However, in developing the best method from the list of four, all are reasonably dependent on the primary purpose for which transfer prices are to be established. Again, there are two objectives: (1) performance measurement and (2) good congruence. With this in mind, the works of others as it applies to transfer pricing in use is now examined.

The first article to be summarized is by Jack Hirshleifer. This article is one of the first works on transfer pricing and most articles that follow use this one as a basis in developing other theories and/or approaches

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[1] Holstrum and Sauls, p. 29.

to transfer pricing.

In his analysis Hirshleifer identifies only two of the four previously identified alternatives.[1] The key to this approach is whether or not an external market exists for the product to be transferred. Simply stated, if an external market does exist and is competitive, the product should then be transferred at the prevailing market price.[2] If an external market does not exist or if it does and is non-competitive, the product should be transferred at a price equal to marginal cost. Thus, the two alternatives identified by Hirshleifer were market price and marginal cost. To illustrate Hirshleifer's methodology, let's assume an external market does not exist for the intermediate product. Therefore, a market price does not exist and the supplying division does not have a means to dispose of surplus. Under this situation, a "best joint level" of output must be determined. This means that the buying division will acquire and process exactly as much output as the supplier will produce. The determination of the transfer price is therefore based on the "best joint level" of output which must be determined first.

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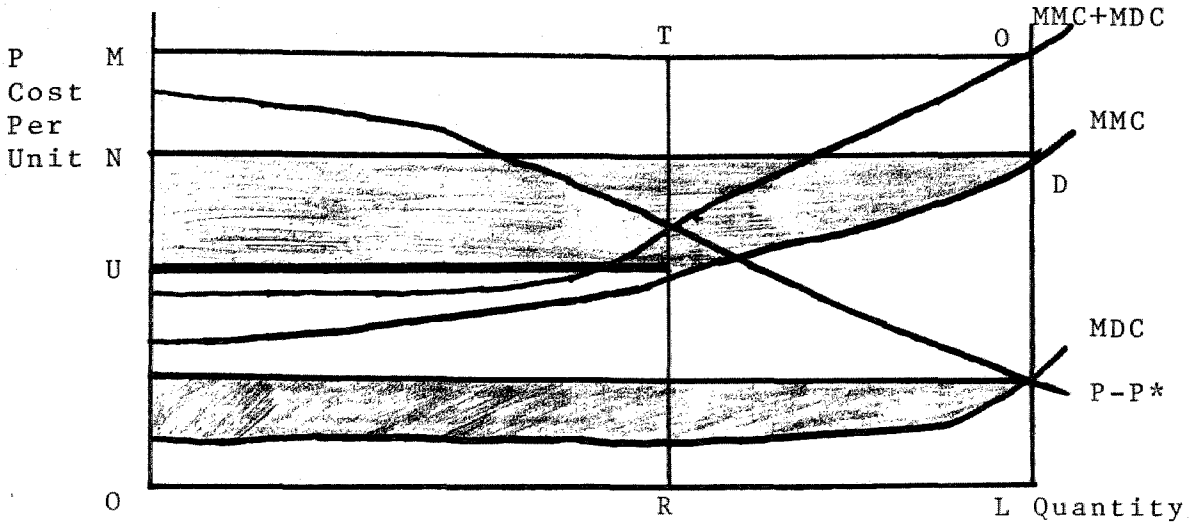
[1] Hirshleifer, p. 172.

[2] Hirshleifer, p. 172.

Best Joint Level



In the above illustration MMC and MDC represent the marginal cost of the manufacturing division and the marginal cost of the distribution division respectively. It is assumed that the final product has a competitive external market and faces a prevailing market price of P. The best joint output would be where MMC + MDC = P, that is, where the combined marginal costs equal the price of the final product on the open market. Given P equal to OM, the best joint output is OL.

According to Hirshleifer, this same output (OL) can be derived by establishing the transfer price.[1] This approach requires the assumption that the distribution division knows exactly what the manufacturing division is going to produce at any transfer price. Rationally, the

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[1] Hirshleifer, p. 173.

manufacturing division would establish its output at the level where MMC equals transfer price, i.e., costs would be recoverable. Technically, according to Hirshleifer, the prior statement is only true where MMC exceeds average variable cost.[1] With this information, the distribution division can establish a curve showing the difference between market price of the final product and the transfer price of like intermediate products for any level of output which might be set by the manufacturing division. The distribution division would establish its own output where MDC equals the difference between market price and transfer price (market price and MMC, MMC equals P*) at point OL. In the diagram above, the shaded area on the top represents the profits of the manufacturing division, and the lower shaded area represents the profits of the distribution division.

There is one major vulnerability with this approach that could be detrimental to the firm as a whole. To explain, the distribution division could very easily establish a quasi-marginal revenue curve marginal to market price minus transfer price (P-P*), and accordingly, establish an output of OR with a transfer price at OU. In essence, the distribution division at this point is acting as a monopolictic buyer and is taking advantage of the manufacturing

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[1] Hirshleifer, p. 174.

division. The distribution division under this new arrangement would increase its own profit, at the cost of the manufacturing profit. The interesting fact is that the gain to the distribution division would be more than off-set by the loss of the manufacturing division and as a result the firm as a whole would lose profits. This particular situation could also take place by the manufacturing division becoming a monopolistic seller. This would mean that the manufacturing division would be using the demand function of the distribution division as the key to output as opposed to a supply function as key.

The vulnerabilities are pointed out to draw attention to cooperation as an essential factor in this type of arrangement. It is obvious that since performance is measured on profits, the division managers may try to extend their influences over the other. Conclusions are that transfer pricing no matter what alternative is chosen, requires monitoring by corporate managers, even though one division is showing a significant profit, it may be at the expense of the other division, and accordingly, may be detrimental to the firm as a whole.

The above analysis of Jack Hirshleifer's work is only a summary and does not go into the detail of market competition as he did. It is not required for the purpose intended in this paper.

Troxel acknowledges the four alternatives as dis-

cussed earlier, but feels that no one method of transfer pricing can effectively satisfy all the objectives of a decentralized organization.[1] Therefore, he developed a "dual pricing" approach. This approach is based on two key considerations: (1) the supply division would compute its revenues from intercompany transfers based on a negotiated or calculated price; (2) the receiving division would receive the product at a cost equal to the variable/marginal costs of the supplying division together with a budget portion of its fixed costs. In other words, pay the exact input cost of the product, no mark-up for profit (not the negotiated price). In the above analysis, variable cost is the cost incurred by the firm for variable inputs in the production process, whereas marginal cost is the additional cost resulting from the addition of the last unit of output.

As Troxel determined, under this approach the supplying division would continue to be influenced by the profit incentive and thusly expand output for both external markets, as well as the internal market. On the other hand, the receiving or buying division would not be confused with artificial profits, and would be paying the actual cost to the firm. The fixed cost being applied would be necessary in making the buying division aware of the total costs involved and any request for additional volume would accord-

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[1] Troxel, p. 896.

ingly offset an increase in the fixed cost proportion. The one glaring short-coming of this approach, as acknowledged by Troxel, is the problems involved in administering two sets of prices for the same product. In any case, both performance measurements and profit maximization are supported by this approach, if one can be satisfied with pseudo profits as would be the case of the supplying division.

An article by Gary L. Holstrum and Euegne H. Sauls has a different approach, in that "opportunity cost" is brought into the analysis. Again, the four alternatives, or a form of them are readily identified. Briefly, their conclusions are that the market price, full cost and marginal cost approaches lend themselves to performance evaluation, but contributed very little to the objective of goal congruence.[1] The fourth alternative on the other hand makes absolutely no contribution to either objective, but in reality is a measurement of a manager's 'horse-trading" ability.

The reason given by Holstrum and Sauls as to the lack of goal congruence is the absence of opportunity cost. As stated, "the establishment of an appropriate transfer price should be based upon the opportunity cost of the manufacturing and distribution divisions with respect

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[1] Holstrum and Sauls, p. 29.

to "marginal" or incremental units to be transferred".[1]

In other words, an organization will profit by internal transfer of products only if the opportunity cost of the receiving (distributing) division is greater than the opportunity cost of the supplying (manufacturing) division.

The term opportunity cost means the benefits or profits provided by the next best alternative. As it applies to the current theory, it works in the following manner. Goal congruence is obtained only when the supplying division's transfer price is equal to or greater than the benefit supported by the next best alternative. That is, the alternative (transfer price) is as good or better than any other alternative available. This then implies profit maximization. On the other hand, the transfer price must be equal to or less than the opportunity cost of the receiving division. In this case, the receiving division is securing the intermediate product at the least cost available (cost minimization). Therefore, not only do the supplying and receiving divisions stand to gain, but based on this approach the firm as a whole would benefit.

To illustrate this approach, the following models depict the opportunity cost for the manufacturing division and the distribution division.

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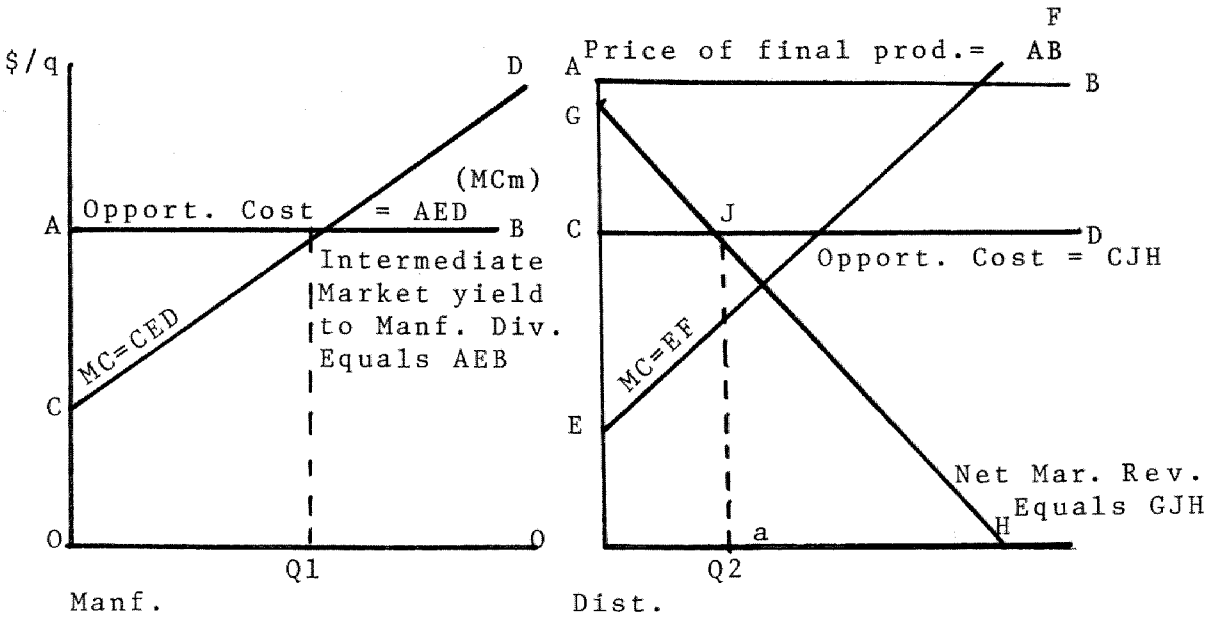
[1] Holstrum and Sauls, p. 29.

Opportunity Cost



Two assumptions are required: (1) the final product is sold in a perfect competitive market and (2) the intermediate product is bought/sold (transferred) in a perfectly competitive market. That is, both the manufacturing and distribution divisions have the option to buy/sell within or on the external market and neither can influence the other. Given these two assumptions, the following statements can be made with respect to manufacturing and distribution opportunity costs.

Manufacturing Opportunity Cost

The opportunity cost of a unit to be transferred at a quantity of Q1 or less would be OA. This in essence is the price of the product in the open market less distribution cost. At quantities in excess of Q1, the opportunity cost is the marginal cost along ED which is an incremental

unit. As a result, the opportunity cost is the greater of: (1) marginal cost CED, (equal to or greater than), (2) the price (AEB) of selling on the open market. Thusly, the opportunity cost would be AED.

Distribution Opportunity Cost

At this point and based on prior analysis, the opportunity cost must be equal to or lower than the following two factors. One, net marginal revenue (GJH) (the price at which the final product will be sold less the marginal cost incurred), and two, the price that would be paid by the distribution division if the product was bought on the open market (CJD on the above graph).

Consequently, the opportunity cost would be the line CJH. At quantities up to Q2, the distribution division has a choice of buying on the open market, or internally, since at this point the opportunity cost and market price (CJ) would be equal. But, for quantities in excess of Q2, the transfer price would be the most advantageous since the opportunity cost would be equal to the net marginal revenue (JH) as opposed to the open market where the cost would exceed the net marginal revenue. The net marginal revenue is the difference between the price (marginal revenue) of the final product and the marginal cost of the distributing division.

In concluding on this approach, transfer price based on opportunity cost, when the transfer price is established

at a level at which the opportunity cost of the supplying division equals the opportunity cost of the manufacturing or receiving division, would lead both divisions to operate at the level most beneficial to the firm. On the other hand, if both try to exceed the quantities established at the opportunity cost, performance would be negatively affected.

W. H. Crompton sees transfer pricing as a means to promote cost reductions and invite competition between the divisions. He only acknowledges three common transfer pricing methods: (1) full standard cost, (2) marginal or variable cost, and (3) market price. He differs only from the initial four in that he does not recognize the negotiation method. However, he does feel that all of the three listed above are subject to manipulation.

He views the full standard cost as the most commonly used and the simplist of the three. He sees a serious drawback with this method in that the receiving division receives the benefits of margin, whereas the supplying division has no incentive to reduce cost.[1]

Marginal cost is very similar to the full cost approach as it also provides no incentive for the supplying division to reduce cost. In both of the above approaches, to transfer on a cost basis, regardless of the cost,

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[1] W. H. Crompton, "Transfer Pricing: A Proposal," Management Accounting, April 1972, p. 46.

provides no initiative to reduce cost or to be in tune with Corporate goals.

His third method "Market Price" allows for negotiations when the price offered is between the incremental unit cost of the supplying division and the market price. Crompton views this as resulting in bad decisions, since the gamesmanship involved appears to be more important than effectively managing the division.[1]

With this quick summary, it is obvious that Crompton has rejected all three alternatives primarily because they all lack a cost reduction incentive. He feels very strongly about distributing the sales margin on the final product among the divisions which contributed in way of an intermediate product. He developes such a method based on a mathematical formula. In its simplest form the formula would be as follows:[2]

$$M = S - (Ca + Cb)$$

Corporate profit M is calculated by the sales price S minus the standard cost (Ca) of the supplying division plus the standard cost (Cb) of the distributing division, and further the transfer price would be calculated as follows:

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[1] Crompton, p. 46.

[2] Ibid.

$$\text{Supplier } Ma = \frac{MCB}{Ca+Cb}$$

$$\text{Receiver } Mb = \frac{MCa}{Ca+Cb}$$

Simply put, from the above, each division receives margin credit in proportion to the cost incurred by the other. Now affix to this formula budget constraints and you have introduced cost reduction incentives and competition among the divisions which in all cases would be beneficial to the corporate goals. In summary, "This method has the following features: Corporate profit and plant profits are maximized together. It provides interplant cost competition, promotes interplant cooperation in shrinkage, reduction, improves incentive to control inventory and hastens shipments, encourages new business through accurate estimating, is simple in concept, minimizes executive attention required and adds little in the way of accounting complications".[1]

Even though Crompton refers to cost reduction and competition among the divisions as the primary objective of transfer price, it also implies performance and goal congruence which were discussed earlier as the summary objectives of transfer price. However, it appears that rewards are only given to those that reduce costs significantly; to stay on plan receives no rewards.

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[1] Crompton, p. 48.

An analysis by R. E. Vendig appeared in CPA Journal September 1973, titled "Transfer Pricing: A new Perspective." It is similar to the previous analysis in that it also saw shortcomings in the four alternatives discussed. This analysis devised a very simple but significant approach to transfer price which it called "direct costing".[1]

Basically, it works simply in that the supplier and receiver would together forecast the product required specifically by the particular buyer. With the forecasted level, the transfer price is developed by the buying division agreeing to pay the supplying division its budgeted fixed costs plus the standard variable cost for the product actually transferred. The results of this approach would be that the buyer, if requiring more than forecasted, would benefit since an agreed to budgeted fixed cost was paid, but on the other hand would be penalized if it required less than forecasted. The supplier would benefit since it has control of fixed and variable cost and would strive to stay below budget, and if cost went up, he then would be penalized. This approach in a sense is a combination of the "Full Cost" and "negotiated" methods, since the costs are the key agreements and are reached on a forecasted requirement.

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[1] R. E. Vendig, "Transfer Price: A New Perspective," C.P.A. Journal, September 1973, p. 806.

This approach would encounter difficulties if an external demand was created for the product regardless of the buyer's position. The supplier would be somewhat constrained from taking advantage of a profitable external market, unless he possessed excessive production capabilities.

In concluding, the intent of this chapter is to convey an elementary but basic understanding of transfer price theory. It is important to point out that transfer price theory is a relatively new subject in the studies of economics and therefore, there is very little in the way of studies, analysis, and research related to it. This is expecially true with respect to its application to computer services.

In any case, four alternatives to transfer pricing have been identified and reviewed: (1) market price, (2) negotiated price, (3) full cost, and (4) marginal cost. Even though these were the four most generally discussed, none were established as the key alternative. On the contrary, all were criticized for shortcomings and were replaced by variation of other approaches: (1) dual pricing approach, (2) opportunity cost, (3) sales margin evenly distributed, and (4) direct costing. These four, being variations of the original four, were developed for specific goals; purposes in mind. This is an important consideration. All eight of the approaches discussed appear to be

reasonable, however, the key factor in all cases is the purpose for which transfer price is to be developed. For example, if the performance measurement of the selling division is the primary goal, then market price would be the best method of inter-company pricing. If a method is required to insure maximization of overall profits; the inter-company transfer should then be based on marginal cost. If the purpose is to encourage managerial involvement and enthusiasm, negotiated price would be the method to use. The full cost approach allows for the proper costing of the intermediate product, both variable and fixed. Thus, by passing this data to the distribution division, the distribution division would use it in establishing its final product pricing structure.

In other words, no one method of transfer pricing can effectively satisfy all the informational needs of a decentralized organization. Only one will come close to satisfying all the needs, and it would be that one which would then be labeled as the "best". Again, "best" only as it relates to satisfying the purpose in which it was intended, however unique this purpose may be.

Again, transfer pricing simply means the price which products/services would be transferred among divisions of a firm in the development of the final product. In the chapter that follows, the four alternatives of transfer pricing will be fit to the unique requirements of computer services.

Chapter III

"TRANSFER PRICING" AND COMPUTER SERVICES ENVIRONMENT

In the previous chapter transfer price theory was reviewed in general concepts, as well as, in some specific detail. The intent was to provide the reader with a basic understanding of transfer pricing and to familiarize him with the type of application to which it is most generally applied. To summarize briefly, there are four general alternative methods of transfer price: (1) market price, (2) negotiated price, (3) marginal cost, and (4) full cost. Each one, depending on the objectives, was better than the other. The concensus was that not one method was any better than any other. The key to the selected alternative, or variation of, was the purpose in which transfer price was intended.

An area that is not specifically addressed in the previous chapter, but is mentioned several times, is the environment in which transfer price is being utilized. It is important that the specific environment be clearly understood as it has a direct impact on the approach that can be taken with transfer price theory. In all cases previously reviewed, transfer price theory is addressed as it related to decentralized organizations, i.e., the buyer and seller were divisions of a firm. Each is considered a

"profit center" with autonomous decision making; in essence, each is a small or large business endeavor in itself. To be more specific, the primary participants in the buying and selling are the manufacturing and distribution divisions. The product being transferred is referred to as an intermediate product and is a last step toward the final product, i.e., is a necessary part of the final product. In all cases, when a method was discussed, it was discussed in light of a definable unit being transferred, and in all, one unit as opposed to several different types of units. This is not to imply that services are not supported by transfer price but to emphasize that tangible units are easily adapted to a transfer price. In concluding then, transfer price has been associated with the following environment; decentralization, divisions, profit centers, intermediate products, and a tangible unit of output. With the above brief summarization of transfer price and the environment in which it is intended, it is the intent in this chapter to clearly define the environment in which to apply transfer price theory.

The environment which is to be defined is not a hypothetical case, but in fact, is a data processing department of a major farm equipment manufacturing firm. Therefore, in the development of a transfer price system (computer services) actual data will be utilized as the basis for the development of this system. This is an important

consideration in the development of the proposed transfer price system for two reasons: (1) all factors either real or intangible will be accounted for, as they do in fact exist in a real environment, (2) actual computer supplied data will aid in determining the feasibility of such an approach. The computer is also the tool in supplying the required data in support of services rendered and resulting charges. The first major fact in the definition of the environment is that the supplying unit, in this case the data processing function, is not a division or considered a profit center. It is a department of a major division of the firm. This initial fact establishes a completely new wrinkle in the application of transfer price. As the reader will recall, the previous chapter addressed transfer price as it applied to divisions of a firm and not to a department of a division.

The second factor to be defined is output, the product to be transferred is not the last level of intermediate product necessary for the development of the final product. The final product in this case is farm equipment coming off the assembly line being readied for shipment to points of retail outlet. The output of the data processing department is only one of many intermediate services or products required for the final product and in most cases is the intermediate type product for other intermediate products. Again, another new factor has been introduced.

The third factor to be defined is the unit of output. In the case of data processing, there is not one all inclusive unit that may be considered the representative output unit. To compound this situation, data processing produces intangible products, as well as tangible. In any case, for transfer price theory to be applied a unit of output must be defined, and in this case either a tangible unit or an intangible unit, or a combination of the two could very well be the result. In step with the above two factors, again a new wrinkle has been introduced.

At this point, the bases of transfer price theory as previously reviewed has become somewhat confusing. In essence, transfer price as a theory is now being applied to a "real situation", and consequently, the factors which it was based on in theory change when applying to a real situation. Transfer price theory as it is known today will be applied to an environment unlike any it has been utilized in to date, at least as supported by the findings of Chapter II. As the title of this paper reads "Transfer Pricing --- can it effectively be applied to computer services?" the intent is to establish a means or prove it cannot be established. The first objective has been clearly defined, can it effectively be applied to computer services?

At this point the stage has been set; the objectives have been identified. In light of conflicting requirements of this application as opposed to past applications, three

basic differences have been identified: (1) departmental, (2) intermediate product to other intermediate product, (3) not a clearly established unit on which to base the transfer price.

Getting back to the intent of this chapter, the definition of the environment, there are primarily two major functions of a data processing department: (1) data processing of required information, (2) systems development. It is these two functions in which a unit of output must be established to attach a transfer price. Unfortunate as it is, there is no one unit that can suffice for both. In fact, there are three basic units that must be accounted for: (1) computer processing-batch, (2) computer processing-online, and (3) system development. Given these three areas, there is no one unit representative of all. To explain, the three units are briefly described.

Computer processing-batch. This type processing is the most familiar and widely utilized in data processing. It simply means that the data will be processed via input previously prepared by the user, key-punched, and loaded for processing transparent to the user. The output from such processing is normally available within 24 hours, printed and delivered to the recipient.

Computer processing-online. This type of processing involves user involvement via terminals located in his area of responsibility. Basically, key-punching is replaced by

the user entering the data directly into the computer for "NOW" processing, i.e., online via a CRT terminal located in his immediate area. The output from such an environment is transmitted instantly by the computer to a screen (similar to a TV screen) on the terminal or to a printer for hard copy (paper) located also in the user area. This is interactive processing (online), the user communicates directly with computer, and for output, the computer communicates directly with the user. This is not to be confused with time sharing, where a user can submit jobs through a terminal for batch processing immediately or at a later time.

Obviously, the above two definitions are oversimplications of the processing mode, but for purposes intended in this paper will suffice. The important consideration is to understand that the cost of batch processing versus online processing is "grossly" different. There are two reasons for this. First, a more sophisticated operating system is required to support online processing. Second, special equipment and skills are required for online processing, such as terminals, teleprocessing lines, special control units and the knowledge to put it all together in just the right mix to have it perform at its most capable level. As a result, online processing is more expensive and there is no common unit that can be established as output for both.

Systems development. Unlike the processing cost as described above, systems development involves the creation

of a system to support required processing. Whether it be online or batch processing people are required to define, design, program, and install the system. This is a very costly undertaking and involves hours expended both by people and computers (as required for testing prior to implementation).

Again, a common unit of output to represent all three in the estimation of the writer cannot be established. As a result therefore, three units of output have been defined: (1) processing-batch, (2) processing-online and (3) developmental. At this point, the environment is defined as follows: departmental, intermediate product leading to other intermediate products and three units of output.

The fourth factor important to the definition of the environment is the condition that a "zero budget" approach be applied. This simply means that the department is not going to operate as a profit center, i.e., profit and loss based on revenue secured. The primary reason for this is that the department as opposed to division concept is, in fact, the case. Divisions being competitive for performance reasons, departments on the other hand are the players of the division and do not compete. The second reason being that this is the policy of the manufacturing company being used to support this study. This can be construed as an assumption required in arriving at the final solution.

Given these four above mentioned factors as the

environment, what then is the alternative of transfer pricing that would satisfy the objectives based on the given criteria? To arrive at this solution the four transfer price alternatives will be applied to the environment.

Prior to embarking on this analysis, there is yet some groundwork to be performed; the unit on which to base the transfer price must be defined in a cost reflective mode. To explain, previous conclusions were reached indicating that three different units are required as opposed to just one product. Again, these units are: batch processing, online processing and developmental.

The above are service units, and accordingly categories of cost. To explain, a cost must be established on which to base a transfer price. For instance, as it relates to batch processing, what is the basis of the charge, what cost of "something" establishes a rate, core utilization, storage, processing time or a combination of these?

The following units of transfer have been established: batch processing based on processing minute, online processing based on terminals within the using area, and developmental based on hour expended. The determination of the above units is not really relevant to the intent of this paper, but only that a unit be established. The reason for this position is that the determination of the unit involved numerous trial and error attempts which in itself would support a large report. However, a short explanation of

the basis for selecting the above units is necessary to fully understand the resulting transfer price.

Developmental: charge per hour. Of the three cost categories, this was the simplest to determine. People-time is costed out by the hour. The time required by the computer for testing would be costed out in the normal batch processing cost method and will be addressed in that area.

Levels of skills were not separated. A programmer and an analyst would be costed the same per hour. This in itself is somewhat contrary to the criteria of equitability. However, to do it otherwise would require a matrix of rates per skill level. This then could result in personnel being selected by the user to do a specific job based on a rate per hour; managing problems for the data processing department would be massive. In any case, the rate per hour was derived as follows: taking the total systems development budget which includes the following (all fixed expenses): salaries of analysts and programmers, salaries of manager, fringe benefits on the above, online systems that expedites development (T.S.O.) which would include hardware cost for terminals, supplies and housekeeping expenses, and technical education and travel. Calculate the monthly expense (total budget ÷ 12); the daily expense (monthly budget ÷ 22); and finally an hourly expense (daily ÷ 8). (Note: 22 working days per month).

The hourly rate was then determined by dividing the

hourly budget expense by the number of programmers and analysts actively engaged in systems development.

The hours worked are mechanically controlled via a "project control" system which reports monthly the hours expended per system under development. Following are the actual calculations:

Factors Included	1976 Cost
Salaries & Fringe Benefits	$1,157,300
Travel & Education	85,900
T.S.O. Terminals	273,800
Development Cost	1,517,000
Monthly Cost (1,517.3 ÷ 12)	126,400
Daily Cost (126.4 ÷ 22)	5,800
Hourly Cost (5.8 ÷ 8)	.725
Hourly Rate Per Person (.725 ÷ 57)	$12.72

Batch processing: charge per processing minute. Cost allocation for data processing has always been a complexed undertaking and with the advent of multi-processing (more than one job sharing the computer resources at the same time), the problems become even more complicated. The unit on which to base batch processing was the most difficult to determine. Many variables (resources) are involved. For example, CPU cycles, tape/disk utilization, storage requirements, or combinations of these; which should be the unit? To be completely accurate, all must be accounted for. However, if this was the case, the cost unit would be too

complicated and technical to explain to the user. Because of this, "process minute" was selected as the unit of measure. This unit is simply the elapsed time from the beginning to the end of the job weighted for resources (tape/disk) used. The minute is calculated as if it was processed in a stand along mode (non-multiprocessing).

The actual dollar rate established per process minute was developed very similar to the way the hour rate was calculated. Again, taking the approved operations budget for the year and applying actual minutes of processing (based on 24 prior months history projected the next 12) as opposed to actual minutes available in a day. It must be approached this way since the computer is not processing around the clock seven days a week. To base it on a 60 minute hour, a 24 hour day would grossly under value the unit, resulting in under charging.

The "process minute" is supplied by a Systems Management Facilities program (SMF), an IBM software package, which monitors and records all activity (batch wise) within the computer on a 24 hour basis. The calculations appear as follows:

Factors Included	1976 Cost
Hardware (Computer Equip.)	$2,299,800
Software (Computer Prog.)	101,000
Computer Forms	586,000
Salaries & Fringe Benefits	1,608,300
Outside Services	127,000
Supplies & Education	29,900
Travel Expense	10,100
Yearly Batch Processing Cost	$4,762,100
Rate per minute	$3.32

Total minutes (3 processing locations) of 1,434,240 was arrived at by calculating actual past 12 months usage and projected usage for the next 12 months.

Online processing: charge per terminal.

The most accurate way to charge for online processing is to offer a rate per transaction submitted and account for resources utilized in the completion of the transaction. This was the conclusion of the author's investigation on this particular category and also supported by some software packages (cost system) now available on the open market. However, this particular approach cannot be supported with the technology currently available on the installation under study. This being the case the "terminal" was selected as the unit to affix the transfer price of online processing. The rate determined is based on the following items: the

cost of special operating systems to support online, the cost of teleprocessing lines, and the process time required for online. Process time is supported by the batch process charge as described above by extending the "process minute" per the average "up time" for online requirements per day. This total is divided by total index units (number of terminals multiplied by months in use) resulting in a charge per terminal per month. This would be referred to as an "allocated cost" per terminal based on overhead. To this, add the monthly rental (cash equivalent) of each terminal and you have developed a rate per online processing. The rate becomes a fixed rate per terminal and does not vary for the year.

Following are the calculations of the online processing charges:

Factors	1976 Costs
Hardware (online equip.)	$415,100
Software	11,000
Computer Utilization	485,200
Total Online Cost	911,300
Rate per Terminal	$520,00

The above $520.00 rate is based on having 146 terminals in use at the end of 1976. Chapter V will explore this approach in much more detail.

To summarize, the rates established per unit are based on the total planned budgets of the data processing

department. This is to ensure the "zero budget" approach, i.e., no profit, or no loss situations. One vulnerability that exists in the above analysis is that the rates would change given more sophisticated hardware, more or less people, and more or less terminals. But, this problem is overcome by establishing the rates as "standard cost" at the beginning of the billing period, say for a fiscal year, and only adjusting at the beginning of the next fiscal year. In essence, based on projected trends, the standard cost may well be high at the beginning of the period, but would be low toward the end. Thus having an equalizing effect for the full year.

From the above unit-rate approach, it appears that an environment has been developed which is contrary to the objectives of transfer price as discussed earlier. It was indicated that the two primary objectives of transfer price are, performance measurements and goal congruence. It appears that the incentive to ensure either objective has been eliminated, or has it?

Let's examine the objectives in light of the unit/rate establishment. Performance can be measured by adhering to budget constraints, reducing cost to come under, as well as, showing profits. This was proposed in earlier readings as related to transfer price. Budgets are reviewed and often times revised by upper management; again, adhering to the budget would certainly be "goal congruence".

In any case, the environment has changed from that under which "transfer price" was reviewed, and so have the objectives. In recalling Chapter I, it was the high cost of data processing which prompted a "transfer price" to be reviewed for applicability. With this in mind, the objectives of transfer price system as applied to computer services should be: (1) to justify/explain the high cost as related to data processing, (2) to reduce cost by having the user select those projects that he (user) is willing to pay for, (3) to support additional hardware requirements and (4) to improve management skills. Even though it is explained differently, as a by-product of attaining these particular objectives, by default you have performance measurement and goal congruence.

With the ground work now complete, let us examine the four transfer price methods. Hopefully, one can be selected as the means to applying transfer price.

Chapter IV

DETERMINE THE BEST ALTERNATIVE

In this chapter, the four alternatives of transfer price are applied to the computer services environment with the intent of establishing the one that will best support all requirements.

Market price. Using this alternative means that an external market would exist for the product/service, and that the seller and buyer would have the option to sell externally and buy externally respectively. Assuming this to be the case, the following types of transactions could take place:

1. Contracting analyst/programmer to do a specific job on internal equipment for internal processing.
2. Contracting analyst/programmer to do a specific job on external equipment for external processing.
3. Purchasing a completed program product to be processed internally.
4. All three of the above in reverse i.e., contracting the internal staff to develop systems for external buyers for processing either by the external buyer or on internal equipment.

5. Selling just computer time for external uses.
6. Buying external computer time for additional processing capabilities.

With the exception of number 4, all of the above transactions have been utilized by the subject installation. Number 4 has never been used since it is in direct conflict with company policy. This, however, does not automatically eliminate market price from consideration. It does, very definitely, put the data processing department in a very dependent position to other departments of the firm without a reciprocating requirement.

Since all of the above have been utilized, the market price is known and, through experience, has always been significantly higher than the comparable internal rate. For example, the rate determination for an analyst/programmer is calculated to be $12.72 per hour. This same rate for similar skilled external individuals would range anywhere from $18.00 to $30.00 an hour. These rates are based on currently published rates of national recruiting and placement firms.[1] There are reasons for this discrepancy. The internal rates do not have a profit mark-up, and the external rate reflects a proportional amount for recruiting, traveling and living expenses. These are legitimate reasons.

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[1] Statement by Max Thayer, Vice President, in a personal interview, Des Moines, Iowa, January 5, 1976.

A profit margin is required for the external firm to stay in business and, based on the particular skill required, all recruits have to be moved to Des Moines specifically for the duration of the contract which normally runs 9 to 12 months.

Another important fact to consider, with the exception of contracting skilled people and number 3 above, all other types of transactions as outlined are no longer feasible due to the sophisticated technology currently installed in subject firm. This statement can be supported by the national sales representative of IBM.[1] This in essence eliminates the once existing external market.

Contracting of external programmer/analyst only would happen when a particular project is required "ASAP" and all in-house personnel are currently under assignments. Even at this point, all contracts and contract negotiations would take place through the data processing department. The current state of the art necessitates that the data processing department do this as the user department would be at a disadvantage since they are not aware of current data processing costs. It is important to note that contracting of outside people to come in and work under internal controls and supervision is becoming more acceptable, but not because of cost. Rather, it is because of the lack of

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[1] Statement by William Brown, Sales Representative, in a personal interview, Des Moines, Iowa, November 20, 1975.

skilled people to meet the growing demands of the using departments. This action is taken only after a thorough cost/ analysis has been prepared indicating the cost, as well as, the benefits of such an undertaking.

In concluding on market price alternative, certain areas of computer services could call upon an external market, as well as, an internal market to establish the best approach (cost reflective). However, other areas of computer services such as outside processing do not exist based on current technologies. The two usable external services in all cases are higher than the same service supplied internally, but are called upon as a result of manpower needs.

Negotiated price. As described earlier in this paper, this price usually is established as a close approximation of market price because of the inability to adapt to the prevailing market price environment. This method is nothing more than an agreed to approach established according to guidelines set by corporate staff. Negotiated price, for the most part, is installed to measure the participating divisional manager's performance and productivity.

Given a product or service, a transfer price based on a negotiated price could be established. It would mean that the total cost involved, as well as, other objectives be clearly communicated to both parties involved. It could very easily be utilized on the objectives at hand. However, the approach is not one of negotiations for the best posi-

tion, but to accurately charge services out on a true zero budgeted approach. This is brought out specifically, as this approach appears to be the most commonly used among data processing installations in and around the Des Moines area. In interviews with data processing managers who are currently using a type of costing system, conclusions are that an hour rate is established (clock time) and agreed to by all participants.[1] The rate has no relation to actual computer hours, resources utilized, or budget constraints.

Marginal cost. A transfer price that varies with the output, of the data processing department. Using Hershliefer terminology, a "best joint" level of output must be determined. This means that the buying divisions, or in our case buying departments, acquire and use exactly as much output as the data processing department produces. Again, the approach requires the assumption that the using departments know exactly what the data processing department is going to produce. This "best joint" level can be determined by combining the marginal costs of the buyer and seller, and where the curve crosses the price curve, for the final product, you have the "best joint" level.

Applying this theory to the case at hand would be very difficult. The external price for the final product

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[1] Statement by James Gabrial, Data Center Manager, in a personal interview, Des Moines, Iowa, December 17, 1975.

can be easily determined. However, the final product as discussed in this situation can be anything from a small self propelled lawn mower to a giant 4 wheel drive tractor and range in price from $100.00 to $100,000.00. As indicated earlier, the intermediate product in data processing is the means for several different levels of intermediate products and has no direct cost relation to the final product.

Assuming one final product and that the data processing services was the only intermediate product, the marginal cost could be determined. Again, the three products of data processing are batch processing, online processing and developmental. However, the marginal cost would be determined on a new system, which would be a combination of developmental, batch processing and online services. This then, would be the marginal cost of producing just one more product in the data processing department. In most cases, this additional cost can range anywhere from $50,000 to $500,000 for development only, not to mention the on-going processing expense.

All major projects undertaken in most data processing installations are supported by a "project proposal" and among other things clearly states the cost-benefit of such an undertaking. The cost as reflected in such a proposal would be supported by the anticipated number of process minutes, terminals, and developmental hours, calculated at the rate as established earlier in this paper. In a

sense, the application at hand has the flavor of marginal cost transfer price alternative, with the exception of "best joint" level of output. Data processing is not a function whereby predetermined outputs are reflected. Of course, processing requirements for established systems are known, plans are agreed to on the new systems to be designed and implemented, but what about changing economic climates, special processing requests and possibly even new equipment. Data processing is a service function and must react to the changing business environment. It cannot predetermine a level of output and strive to achieve this goal irregardless of mounting demands. The "best joint" level of output would need be all the hours, all the process minutes totally capable, and all the terminals currently supported by the existing computer configuration. These types of unknowns are inherent in the data processing department.

The above, for the most part, eliminates marginal cost from further consideration. However, if a different approach as related to marginal cost is applied, it may possibly become a viable alternative. To explain, if the marginal cost is based on the three unique service units, the results would show a horizontal curve. This would be the case since in Chapter III each service unit has a rate per process minute, terminal and hour respectively, same rate per each additional service unit expended. Normally, marginal cost decreases when at low level outputs, but after

reaching a minimum level of output, marginal cost increases with further increases in output. This indicates that average variable cost increases with additional increases in output. To establish marginal cost as horizontal, would mean that average variable cost is also horizontal and equal to marginal cost. This, of course, is an approximation based on the application at hand as specifically related to the applicable rate calculations. This approach would have to be substantiated over a long period of time, monitoring the cost trends as calculated in chapter III.

Full cost. A transfer price here is established which includes both variable costs and allocated fixed costs of the supplying division. The cost may be based on standard or actual and the amount may or may not be inflated to account for a specific profit margin. Oddly enough, even though full cost is an alternative generally identified in all the writings on transfer price, the above is basically all that has been written on it.

It is the writer's opinion that this particular alternative, based on the environment and objectives at hand, appears to be the most suited as a start. A "zero budget" approach based on full budget considerations is this alternative without profit margin included. Profit margin in this alternative is an option. The only factors that count are the total cost encountered by the supplying division. Based on this approach as a "start", the hypothesis that

marginal cost is horizontal can be tested over a long period of time.

Earlier in this paper the environment, the units, the rates and the objectives were outlined. It is safe to assume at this point that this alternative could support those requirements; chapter V describes how.

Chapter V

A TRANSFER PRICE SYSTEM

It is the intent of this chapter to develop a transfer price system which would support the data processing environment as described in chapter III. The alternative transfer price method selected for this model is "full cost" as determined in chapter IV.

Data processing resources. Since the transfer price system is being developed to account for data processing costs, the data processing resources will be utilized to support such a system. In other words, a computer system will be designed to gather cost data, compute applicable charges, and generate invoices for the using departments. The system design, business-wise, will be developed and described as opposed to specific program logic. The data processing resources utilized will be those of the XYZ company consisting of the following:

IBM 370/158 control processing unit

3 megabytes of memory

10 tape drives

22 disk drives

1 3705/3706 communication controller

2 3271 online TP controller local

1 3272 online TP controller remote

communications (TP network) to:

Akron	Toronto
Detroit	Brantford
Racine	Kaukauna

multi virtual storage (MVS) operating system

information management system (IMS) online system

time sharing option (TSO) program development

job entry system (JES) spooling package

COBOL and DL1 coding support

Again, in way of a review, three unique charges are accounted for: batch processing, online processing and, systems development. The activity which makes up these charges for the most part is going on 24 hours a day. Without the computer as a tool, these activities could not possibly be accounted for. The first step in this design therefore, is to develop the means by which all activity (data) can be captured.

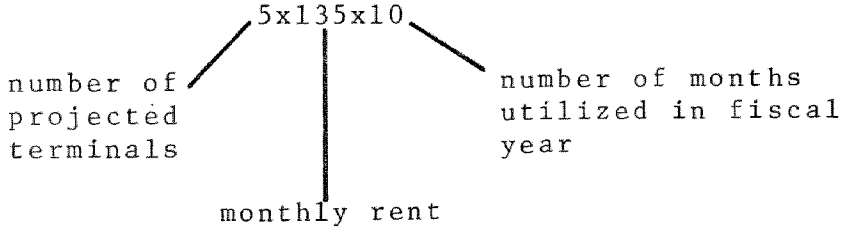
Online processing. This being the least complicated, will be the first to be determined. As you will recall, the charges are based on number of terminals being utilized. It follows that the data is a "fixed" expense and can be recorded on a data set for use by the billing system as required. The data will be recorded by user ID, number of terminals installed and the applicable rate. It is important at this point to emphasize that the rate as determined in chapter III accounts for projected terminal growth and accordingly

projected cost. This rate therefore, becomes a "standard rate" (horizontal marginal cost curve) for the fiscal year and the only change required to the fixed data would be number of actual terminals being utilized.

To expand upon the rate calculation as described in chapter III, a hypothetical case will be presented. Assuming the following criteria, the rate and charges would be calculated as outlined below:

fiscal year Nov. - Oct.

50 terminals currently installed at $135/month rental		$81,000/yr.
20 terminals projected for the year -		
5 in January (5x135x10)	= 6,750	
10 in May (10x135x6)	= 8,100	
5 in September (5x135x2)	= 1,350	16,200/yr.



Online processing cost @ $3.32 minute -		
8 hours/day	$ 1,593.60	
22 days/month	35,068.00	
12 months/yr.	420,816.00	420,816/yr.
Software cost		10,000/yr.
Total projected budget for fiscal year		$528,016

Calculate rate per terminal -

Number CRTS	Number Months Used	Index Units
50	12	600 (50x12)
5	10	50
10	6	60
5	2	10
	Total	720

$528,000 ÷ 720 = $734.00 per month per terminal

To illustrate how this would work, each month will be reviewed for income -

Number of CRTS	Month	Income
50	Nov. (50x734)	$ 36,700
50	Dec.	36,700
55	Jan. (55x734)	40,370
55	Feb.	40,370
55	Mar.	40,370
55	April	40,370
65	May (65x734)	47,710
65	June	47,710
65	July	47,710
65	Aug.	47,710
70	Sept. (70x734)	51,380
70	Oct.	51,380
	Total Return	$528,480

Based on the above, a projected budget of $528,000 and 70 terminals would calculate a rate of $734 per terminal, and as seen, would return $528,480. This is exactly what is required on a "zero budget" approach. However, if the planning that was involved in projecting the additional 20 terminals were remiss either over or under the following would result.

Assume the 10 projected for May never materialized:

Number of CRTS	Month	Income
50	Nov.	$ 36,700
50	Dec.	36,700
55	Jan.	40,370
55	Feb.	40,370
55	Mar.	40,370
55	April	40,370
55	May	40,370
55	June	40,370
55	July	40,370
55	Aug.	40,370
60	Sept.	44,774
60	Oct.	44,774
		$485,908

Deducting the projected cost of $8,100 (10x135x6) from $528,000 would equal $519,900. This means that there would be a negative income of $34,000.

On the other hand, assume 12 terminals were installed in May as opposed to a planned 10.

Number of CRTS	Month	Income
50	Nov.	$ 36,700
50	Dec.	36,700
55	Jan.	40,370
55	Feb.	40,370
55	Mar.	40,370
55	April	40,370
67	May	49,178
67	June	49,178
67	July	49,178
67	Aug.	49,178
72	Sept.	52,848
72	Oct.	52,848
		$537,288

Increasing the projected cost by 2x135x6 = $1,620, and $528,000 plus $1,620 = $529,620 or positive income of $7,668.

It is obvious from the above that planning becomes a very important part of this system. Gross planning errors

can result in critical dollar overages or shortages. This would, indeed, destroy the integrity of such a system. A typical question at this point, and it has been raised several times, why not adjust the rate each time an additional terminal is added to the current configuration. For example, again using the hypothetical case the following would be a method.

Starting with the $528,000 as calculated above, one must reduce it by the projected $16,200 for new terminals.

$528,000 - $16,200 = $511,800

$511,800 ÷ 50 (current CRTS) = $853 per month/per terminal

Add 5 terminals in January - re: calculated rate

$511,800 - $85,300 which has already been expended for 2 months for 50 terminals, add the cost of 5 terminals for 10 months, $6,750 (5x135x10)

($511,800 - $85,300) + $6,750 = $433,250

$433,250 ÷ 55 ÷ 10 = $788 per month/per terminal

Add 10 terminals in May

($433,250 - $173,360) + $8,100 equals

$267,990 ÷ 65 ÷ 10 = $687 per month/per terminal

Add 5 terminals in Sept.

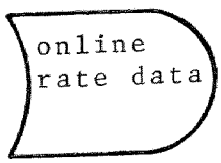
($267,990 - $178,620) + $1,300 equals

$90,720 ÷ 70 ÷ 2 = $648 per month/per terminal

The above outlines a method which would eliminate planning errors, however, it would be obvious to the user

that the more terminals installed, the cheaper they become to operate. It is a very cumbersome undertaking to tune an on-line system in accordance with the number of terminals installed. There is a point of diminishing returns where overall efficiencies are reduced. Therefore, it is the responsibility of the systems department to tightly control allocation of terminals. The above would be in direct contrary, since the user would be looking at it from a cost/return point-of-view and not from technical constraints. Besides, good planning is a factor which depicts good management, this being the case, this system would force good planning and quite possibly result in good management. This approach would also be contrary to the marginal cost curve being horizontal. In this case, marginal cost from the user's point of view would be decreasing as additional output was added (assuming a terminal to be an additional unit of output).

In conclusion, the capturing of online cost data is very simple. A table will be established depicting the user - ID, number of actual terminals and applicable rate. This table will be loaded into the system and made available each time the system is run.



The data would reside as a data set on an online storage

device, in this case a disk drive.

Systems development. The calculation of systems development cost becomes complicated in that the time of many different people must be captured. From the conception of new system ideas to its final implementation in a production processing environment, many different phases of development are experienced. The following phases are typical: proposal phase, design phase, and implementation phase. Generally speaking, the proposal stage involves justifying the system. Why do you need the system, what operating problems are you experiencing that the new system would eliminate, how will it work, how long will it take, how many people will need to be involved, how much will it cost, and what will it save. Normally this phase, depending on size of system, would take from one to three months to complete. In essence it is an investigation and research exercise involving business systems analysts and user representatives.

Given the approval by upper management of the proposal, the design phase would start. This phase would consist of designing the system, number of programs, files, type of input, batch or online or both, and processing procedures. In essence, the system would be completely written in "book" form, all that would be required is to implement it. The implementation phase consists of taking the design specifications and turning them into "code" (programs). This phase would utilize the computer for significant support, program

compiling, testing, file loading, job control language testing (J.C.L.), systems test and final user testing. These two phases, design and implementation, can last from one month to several years.

The above has been a very brief description of what happens from conception to final production of a system. To do justice to the above phases in detail would be far beyond the intent of this thesis and would require several chapters. The intent is to emphasize the different phases, tasks, and people involved. To capture people time and computer time becomes a very complexed undertaking, but without it, there is no transfer price system.

There are probably many different methods that could be used to capture this data, anything from a simple manual record keeping to complexed mechanical means. For the purpose of this system, a "project control system" is being utilized to capture this data.

Briefly, this system, as its name implies, is a project control system and its intent is to measure and control project activity from conception to final completion. It basically works in the following manner. Phase plans are developed with system identification, all activity per analyst involved is reported against the plan. The system is used to measure actual against plan, as a by-product, a data set is created for the transfer price system consisting of all activity expended on the particular system under devel-

opment. This data set is input to the transfer price system and rates are applied for the actual charges. The computer time utilized is captured as is all batch processing time and reported on as systems development time. This procedure will be explained in the batch processing data capturing area.

In concluding, systems development data is captured via a "project control system" and is input to the transfer price system on periodic bases.

Batch processing. All systems which are processed are identified by a unique system code. These codes are identified as to primary user and secondary users, i.e., more than one user department may utilize one specific system.

As systems are processed, all activity and resource utilizations are captured via an operating system sub-system, in this case the systems monitoring facilities (SMF). This sub-system is an IBM software product and is made available via the current operating system in use. As indicated in chapter III, the SMF program captures data based on process minute as well as on other criteria. It is the process minute which is identified by system which is extracted from SMF and input into the transfer price system.

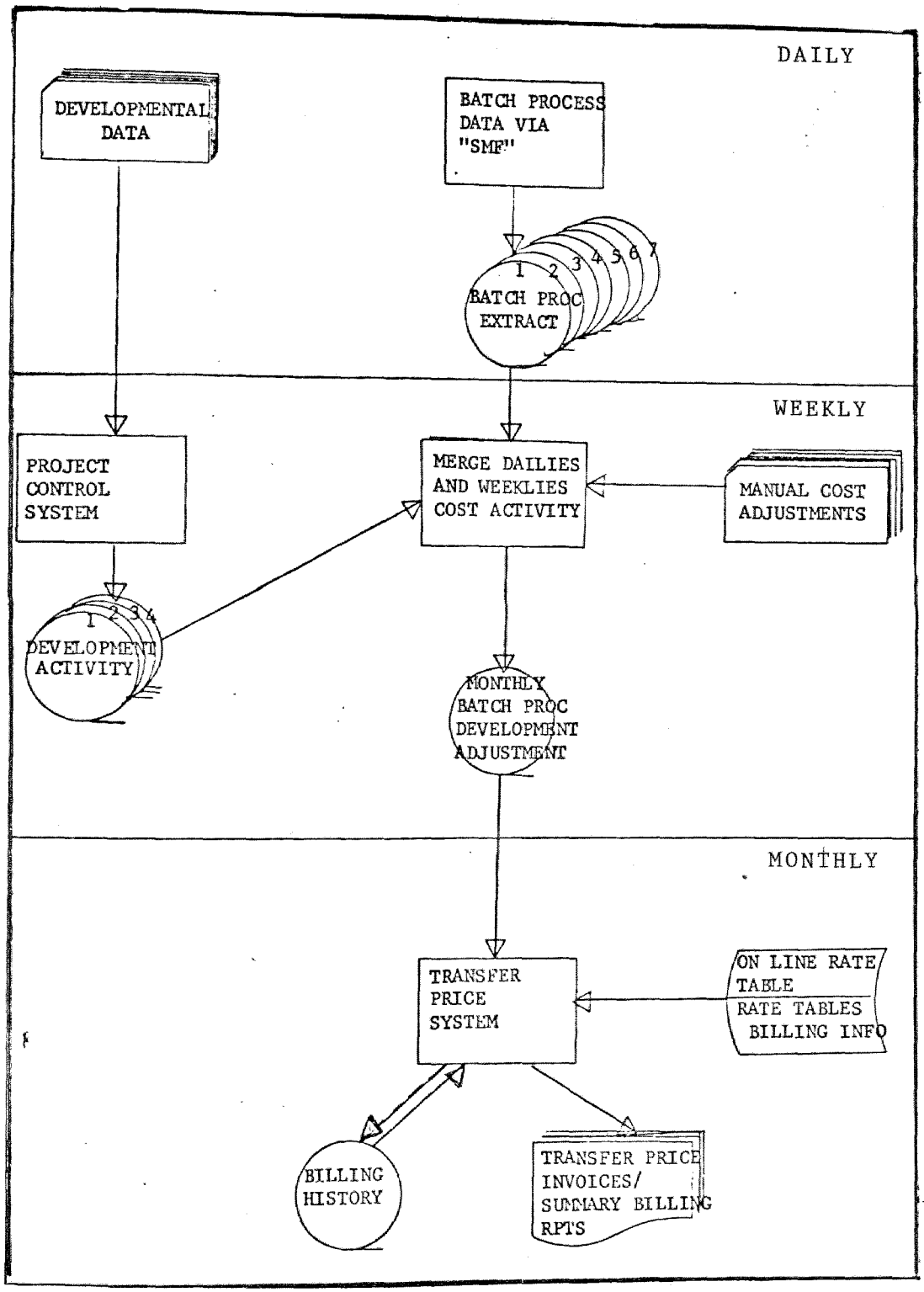
The above has been a brief summary as to how the data; online, batch, and developmental are captured and fed to the transfer price system. Before getting to the trans-

fer price system design, one more input requires definition. This is direct expenses, such as outside services, and adjustments for such things as reruns caused by either user input or operation "goofs." In any case, this type of input provides flexibility in the final preparation of invoices. This input is prepared on input sheets, keypunched and fed into the transfer price system.

At this point all input requirements and capturing of data has been identified, all that is left is to feed the data to the transfer price system and calculate the applicable charges and create the invoices per user's utilizing systems resources. Table 3 depicts the system.

Table 3

Transfer Price System



To explain the flow chart on the previous page, on a daily basis the following activity takes place: systems development tasks are recorded per project control documents and accumulated for the week. Computer processing batch-wise is recorded on magnetic tapes via the systems management facilities package and also accumulated for the week. On a weekly basis, the accumulated data from the daily processing, both project control and SMF, and manual adjustments are merged and retained for month-end processing. During this weekly step, the data is edited and subsequently corrected prior to the month-end run. The monthly run creates the billing information as well as adding the current month's data to the billing history file.

The prededing has been a brief look into computer design, but was necessary to depict data capturing. The transfer price system becomes one of a reporting system, all input capturing and control is supported externally.

The above, for the most part, has been somewhat on a technical basis, however, there are other considerations that must be addressed as related to the transfer price system that are truly business in nature. In the many articles related to computer services charge out systems, three requirements stood out. The major requirements of a cost allocation system appears to be that the charge (transfer

price) must be equitable, reproducible, and understandable.[1] The criterion of equitability means that the buyer will be charged in accordance with the quantity and cost of the resources utilized. Reproducible implies that the same job last month that ran for a fixed duration and at a fixed resource, be charged the same the following month if the durations and resources were identical. Understandability is important in that the buyer must be able to comprehend and accept the cost basis, i.e., the method of associating costs with services rendered should be reasonably simple and straight forward in order to encourage user (buyer) acceptance and comprehension.

This system will also require a full time administrator first, to sell the system to upper management and user departments, i.e., the need for such a system, and what will it accomplish. To do this it must be based on the criteria established above, a system which is equitable, reproducible and understandable. Without this, the system will never be sold. Second, and assuming the system is acceptable, an administrator will be required to manage the billing activities, receive complaints, and resolve all misunderstandings and keep the system at an acceptable level. This consideration will be expanded upon in chapter VI, conclusions and recommendations.

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[1] J. J. Anderson, "Direct Chargeout of Information Systems Costs?" Management Advisers, March 1974, p. 28.

Chapter VI

CONCLUSIONS AND RECOMMENDATIONS

The preceding chapters have dealt with transfer price theory in a data processing environment. Four transfer price approaches are reviewed: (1) market price, (2) negotiated price, (3) marginal cost and (4) full cost. These methods were reviewed for acceptance based on four requirements: (1) equitable, (2) reproducible, (3) understandable, and (4) zero budget.

The market price approach was eliminated for the most part because of the technology involved. With the increasing growth of data communications and online application, data processing installations are becoming more and more uniquely tailored to the firm's own need. Using departments, with the exception of simple stand along processing, could not go external for services. The key constraint would be "integration"; data communications and online applications have resulted in data base structures in use by all departments. To adopt a "market price" approach without the option of the external market would be inequitable for all concerned and specifically the firm as a whole.

Negotiated price could easily be applied to the application at hand, however, it lacks relevance to the processing requirements and related cost in a data proces-

sing environment. To agree upon a price unrelated to the resources utilized would, as above, be inequitable. A fact that it would be totally understandable by the user departments would eliminate it from consideration (the user would reject it). To accept this approach would be very much like accepting the market price approach; a service bureau approach without the option of an external market.

The marginal cost approach appeared to be a way to meet the requirement of a zero budget and be equitable. Because of the nature of data processing, not truly an intermediate product prior to the final product, and the multitudes of tasks required in developing a new system; the marginal cost approach becomes a very difficult undertaking on the outset. However, with the development of a transfer price system, regardless of method, a place from which to start has been established. To explain, cost records, trends, histograms and plain old experience will be the case after months of monitoring a transfer price system. Based on history of cost, the marginal cost approach could them possibly be adopted as approximated to being a horizontal curve.

The full cost approach, as previously determined. has been selected as the method. It is the opinion of the writer that all four requirements will be satisfied by this approach. Full cost in itself does not satisfy all of the objective, but in combination with the rate determination

(criteria) and system design all four appear to be satisfied. The design of the system, being very simple in nature, as related to the three units of cost, batch, on-line and developmental, is understandable, reproducible and equitable. The full cost approach in itself supports the zero budget requirements.

It must be emphasized, that the approach developed herein is at this point theory only. It must be put to the test and tuned prior to becoming a published approach. This would involve a period of three to six months in which the system is utilized in a controlled test environment. Fine tuning can be applied, rates can be adjusted, history can be recorded.

During this period, the administrative duties would clearly be defined. An administrator would be required to support the needs of the system and communicate with the users on the whys and hows of the system. It would be this person's primary responsibility to establish controls, procedures and accordingly, enforce and protect the integrity of the system.

Because of the nature of a transfer price system, the internal controls, planning and management techniques of the data processing department will be put on display for all to review and ultimately judge. As a result, certain internal decisions as related to hardware, software and etc. will be reviewed by using departments. Certain personnel

will be requested for jobs as opposed to internal assignments. All of these will be administrative problems, but must be faced up to. Not only will the data processing department continue to produce services, but will be forced to guarantee (warranties without cost) the new systems as well as continue to promote and support education and quality of the work force.

Finally, prior to official implementation the internal audit department would pass jusgement on the system. This would be more of a formality than a requirement, as the internal auditing department would be involved from conception to implementation. Any other approach would fail. Data processing is still a world of mysteries to many.

In concluding, a transfer price approach has been developed based on the "full cost" alternative. It is the recommendation of the author that this system be used only as a way to establish "data" as a means to substantiate the full cost approach and/or substantiate the horizontal marginal cost approach. Only after this period of time and further analysis can "the" transfer price system be determined.